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AUTHOR Istvan, Edwin J.
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ABSTRACT

The rapidly expanding use of teleprocessing, which is taken to mean automated data processing (ADP) which makes direct use of data transmission via switched or long distance non-switched telecommunications facilities, has highlighted the urgent need for the development of standards for data communications and the computer-communications interface. The National Bureau of Standards is responsible for recommending uniform Federal ADP standards. This responsibility is fulfilled through the Federal Information Processing Standards (FIPS) Program and encompasses the establishment of Federal Standards related to ADP equipment, techniques, computer languages and codes, and the maintenance of an appropriate register and reference file therefore. Over the past few months significant action has been taken toward the establishment of a Federal Telecommunications Standards Program to be implemented in direct relationship with the FIPS Program, and in the clarification of specific responsibilities for the development of standards in support of teleprocessing. The relationships of the two programs and the specific areas of responsibilities are discussed. (Author)

"STANDARDS FOR TELEPROCESSING"

-New Approaches for New Needs-

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BY

Edwin J. Istvan

Associate Director for Teleprocessing

Institute for Computer Sciences and Technology

National Bureau of Standards

U. S. Department of Commerce

Washington, D.C. 20234

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THE RAPIDLY EXPANDING USE OF TELEPROCESSING, WHICH IS TAKEN TO MEAN AUTOMATED DATA PROCESSING WHICH MAKES DIRECT USE OF DATA TRANSMISSION VIA SWITCHED OR LONG DISTANCE NONSWITCH TELECOMMUNICATIONS FACILITIES, HAS HIGHLIGHTED THE URGENT NEED FOR THE DEVELOPMENT OF STANDARDS FOR DATA COMMUNICATIONS AND THE COMPUTER-COMMUNICATIONS INTERFACE.

PURSUANT TO P.L. 89-306, THE NATIONAL BUREAU OF STANDARDS IS RESPONSIBLE FOR RECOMMENDING UNIFORM FEDERAL AUTOMATED DATA PROCESSING STANDARDS. THIS RESPONSIBILITY IS FULFILLED THROUGH THE FEDERAL INFORMATION PROCESSING STANDARDS (FIPS) PROGRAM, AND ENCOMPASSES THE ESTABLISHMENT OF FEDERAL STANDARDS RELATED TO ADP CODES, AND THE MAINTENANCE OF AN APPROPRIATE REGISTER AND REFERENCE FILE THEREFORE. THE FIPS PROGRAM PROVIDES A MODEL WHICH IS BEING EMULATED BY THE TELECOMMUNICATIONS COMMUNITY FOR THE DEVELOPMENT OF UNIFORM STANDARDS FOR TRANSMISSION AND SWITCHING IN COMMUNICATIONS NETWORKS USED FOR TELEPROCESSING.

OVER THE PAST FEW MONTHS SIGNIFICANT ACTION HAS BEEN TAKEN TOWARD THE ESTABLISHMENT OF A FEDERAL TELECOMMUNICATIONS STANDARDS PROGRAM TO BE IMPLEMENTED BY THE NATIONAL COMMUNICATIONS SYSTEM IN DIRECT RELATIONSHIP TO THE FEDERAL INFORMATION PROCESSING STANDARDS PROGRAM, AND IN THE CLARIFICATION OF SPECIFIC RESPONSIBILITIES FOR THE DEVELOPMENT OF STANDARDS IN SUPPORT OF TELEPROCESSING. THE RELATIONSHIPS OF THE TWO PROGRAMS AND THE SPECIFIC AREAS OF MUTUAL AND EXCLUSIVE RESPONSIBILITIES WILL BE DISCUSSED.

"STANDARDS FOR TELEPROCESSING"
-NEW APPROACHES FOR NEW NEEDS-

I. I WOULD LIKE TO SPEND OUR LIMITED TIME THIS MORNING DISCUSSING WITH YOU THE STATUS OF DEVELOPMENT OF TELEPROCESSING STANDARDS IN THE UNITED STATES, AND, IN PARTICULAR, IN HIGHLIGHTING SOME OF THE THINGS WHICH WE HAVE FOUND IT IMPORTANT TO CONSIDER, AS WELL AS SOME OF THE DIFFICULTIES WE HAVE EXPERIENCED, IN IMPLEMENTING A MEANINGFUL PROGRAM OF DEVELOPMENT FOR TELEPROCESSING STANDARDS. I HOPE THAT IN SPENDING OUR TIME IN THIS WAY IT MAY BE POSSIBLE TO LEAVE WITH YOU A BETTER APPRECIATION OF SOME OF THE PRACTICAL REALITIES WE HAVE THUS FAR ENCOUNTERED, AND WHICH MAY ALSO EMERGE AS IMPORTANT FACTORS IN YOUR OWN PROGRAMS FOR THE DEVELOPMENT OF STANDARDS FOR TELEPROCESSING.

II. BRIEF HISTORY

ALTHOUGH THE COMPUTER HAS EMERGED AS AN INCREASINGLY IMPORTANT FACTOR IN OUR ECONOMY DURING THE PAST QUARTER CENTURY, IT HAS BEEN ONLY DURING THE PAST SIX YEARS THAT SPECIFIC ATTENTION HAS BEEN GIVEN TO THE MATTER OF STANDARDS FOR THIS DYNAMIC FIELD.

IN THE U.S.A. THE RESPONSIBLE GOVERNMENTAL BODY WAS ESTABLISHED IN 1966. THIS IS THE CENTER FOR COMPUTER SCIENCES AND TECHNOLOGY OF THE NATIONAL BUREAU OF STANDARDS--THE ORGANIZATION FOR WHICH I SERVE AS ASSOCIATE DIRECTOR. IT, LIKE YOUR CAPRE, WAS CREATED BY PARLIAMENTARY DECREE--IN OUR CASE, BY AN ACT OF CONGRESS KNOWN AS PUBLIC LAW 89-306. IT IS UNDER THIS LAW THAT MY ORGANIZATION EXERCISES SPECIFIC RESPONSIBILITIES FOR STANDARDS WHICH APPLY TO FEDERAL USE OF AND FEDERAL PURCHASE OF, DATA PROCESSING EQUIPMENT. WE CALL THESE STANDARDS THE FIPS--THE FEDERAL INFORMATION PROCESSING STANDARDS, AND THE WHOLE PROGRAM IS KNOWN AS THE FIPS PROGRAM. THIS PROGRAM IS BASED UPON THE FUNDAMENTAL CONCEPT THAT TO THE MAXIMUM EXTENT POSSIBLE, THE STANDARDS ADOPTED AS FEDERAL STANDARDS SHALL BE BASED UPON STANDARDS WHICH ARE VOLUNTARILY DEVELOPED WITHIN RECOGNIZED INDUSTRY STANDARDS ORGANIZATIONS. IN THE U.S.A. THOSE ORGANIZATIONS GENERALLY ARE, FOR OUR AREA OF INTEREST, THE ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE), THE EIA (ELECTRONIC INDUSTRIES ASSOCIATION), AND THE NATIONAL SUBCOMMITTEES OF THE WORKING GROUPS OF THE CCIR, AND THE CCITT IN THE TELECOMMUNICATIONS FIELD.

IT IS IMPORTANT TO PLACE IN PERSPECTIVE THAT IN THE U.S.A., STANDARDS FOR TELEPROCESSING A[illegible] DEVELOPED AND COORDINATED AS PART OF THE FIPS PROGRAM, WHICH ALSO ADDRESSES OTHER ADP STANDARDS REQUIREMENTS, AND THAT FOR TELEPROCESSING, SPECIFIC ATTENTION HAS BEEN GIVEN ONLY DURING THE LAST HALF OF THE SIX YEAR PERIOD OF OPERATION OF THE FIPS PROGRAM.

THERE HAVE BEEN PRODUCED, ADOPTED, AND PUBLISHED THUS FAR ONLY THREE SPECIFIC STANDARDS FOR TELEPROCESSING. TWO MORE ARE IN FINAL PROCESS AND SHOULD BE AVAILABLE BY THE END OF THIS YEAR 1972. SIX OTHERS ARE UNDER ACTIVE DEVELOPMENT AND COORDINATION WITHIN THE APPROPRIATE INDUSTRY AND GOVERNMENTAL GROUPS, AND SHOULD BE AVAILABLE DURING THE YEAR 1973. THIS, PERHAPS, SEEMS A SLOW START. BUT AS I HAVE INDICATED, THE KEY TO STARTING WAS THE IDENTIFICATION OF THE APPROPRIATE ORGANIZATIONS TO BE RESPONSIBLE, IN ORDER THAT THE PROGRAM COULD PROCEED.

III. FIPS PROGRAM OVERVIEW

LETS, THEN, LOOK AT SOME OF THE FACETS OF OUR FEDERAL INFORMATION PROCESSING STANDARDS PROGRAM, AND ESPECIALLY THAT PORTION DEALING WITH TELEPROCESSING.

SLIDE #1 -- FIPS PROGRAM AREAS

COMMENTARY:

- FIPS PROGRAM COVERS EIGHT MAJOR AREAS.
- ONLY ONE OF THESE AREAS DIRECTLY TREATS WITH DATA COMMUNICATIONS AND TELEPROCESSING--BUT OTHERS TOUCH IT INDIRECTLY.
- WE WILL LOOK MORE CLOSELY AT THAT ONE AREA TODAY.

FOR ALL STANDARDS WE FIND THAT A SPECIFIC CYCLE OF DEVELOPMENT IS REQUIRED. THIS CYCLE, WE HAVE FOUND, CAN TAKE THREE OR MORE YEARS TO COMPLETE. (IN THESE SIX YEARS, TOTAL OF 17 FIPS PRODUCED--SOME 20 CAN BE EXPECTED IN NEXT 2 - 3 YEARS.)

SLIDE #2 -- STANDARDS DEVELOPMENT CYCLE

COMMENTARY:

- SEVEN DISTINCT STEPS FORM THE "STANDARDS DEVELOPMENT CYCLE."
- EACH STEP IS TIME CONSUMING.
- OF NECESSITY THE STEPS ARE SERIAL--THEY CANNOT EASILY BE ACCOMPLISHED IN PARALLEL.
- OF ALL THE STEPS, THE "REVIEW AND COORDINATION" HAS PROVED TO BE THE MOST DIFFICULT AND TIME CONSUMING. AS A RESULT, THE ORGANIZATION FOR THE DEVELOPMENT OF STANDARDS HAS BEEN EVOLVED TO TRY TO MAKE EASIER THIS DIFFICULT STEP.
- WE HAVE FOUND THAT THE ONE WAY TO ACCELERATE IS TO TRY TO HAVE CLOSE COORDINATION BETWEEN THE INDUSTRY AND THE GOVERNMENT IN THIS DEVELOPMENT. WE HAVE FOUND THAT IT IS NEITHER NECESSARY NOR DESIRABLE TO ARBITRARILY ADOPT FEDERAL STANDARDS WITHOUT PARTICIPATION BY INDUSTRY. CLOSE COORDINATION AND COOPERATION HAS PROVEN BEST.

WITHIN THE GOVERNMENT, THERE HAVE BEEN ORGANIZED, TO DATE, ELEVEN FIPS TASK GROUPS MADE UP OF REPRESENTATIVES FROM THE CONCERNED, USING GOVERNMENTAL AGENCIES. THE WORKINGS OF THESE TASK GROUPS IS COORDINATED BY A "COORDINATING AND ADVISORY COMMITTEE (FIPSCAC) MADE UP OF SENIOR REPRESENTATIVES FROM KEY AGENCIES OF GOVERNMENT, AND HEADED BY THE NATIONAL BUREAU OF STANDARDS' MEMBER. THE TASK GROUPS FOLLOW REASONABLY CLOSELY THE SEVERAL STANDARDS DEVELOPMENT ACTIVITIES AND COMMITTEES OF INDUSTRY. MORE PARTICULARLY:

SLIDE #3
FEDERAL INFORMATION PROCESSING STANDARDS COMMITTEES

COMMENTARY:

- THE ELEVEN TASK GROUPS ARE:
  1. OBJECTIVES & REQUIREMENTS
  2. DATA TRANSMISSION
  3. SUBSETS, SIGN CONVENTIONS, ETC.
  4. TERMINOLOGY FOR RFP'S
  5. VOCABULARY
  6. MAGNETIC REFERENCE TAPES
  7. MAGNETIC TAPE LABELS
  8. DATA INTERCHANGE FORMATS
  9. COBOL STANDARD
  10. PERFORMANCE EVALUATION
  11. OPTICAL CHARACTER RECOGNITION

- OF SPECIFIC CONCERN WITH TELEPROCESSING ARE "TASK GROUP 2--DATA TRANSMISSION," AND "TASK GROUP 8--DATA INTERCHANGE FORMATS." THE WORK OF TASK GROUP 8 IS ESSENTIALLY COMPLETE, AND MERGED INTO TASK GROUP 2.

- THESE ELEVEN TASK GROUPS INVOLVE THE PARTICIPATION OF SOME 300 TECHNICIANS AND SPECIALISTS WITHIN THE U.S. GOVERNMENT. SOME 30 OF THESE SPECIALISTS DEAL DIRECTLY WITH DATA TRANSMISSION AND TELEPROCESSING.
- A 12TH T.G. WAS RECENTLY FORMED TO ASSESS THE USE OF THE ASCII STD.

IV. STANDARDS FOR TELEPROCESSING

STANDARDS FOR TELEPROCESSING ARE OFTEN REFERRED TO AS DATA COMMUNICATIONS STANDARDS. IN THIS CONTEXT IT IS EASY TO RECOGNIZE THAT OTHER ORGANIZATIONS, SUCH AS THE CONSULTIVE COMMITTEE FOR INTERNATIONAL TELEPHONE & TELEGRAPH (CCITT) OF THE INTERNATIONAL TELECOMMUNICATIONS UNION (UTI), AND THE CONSULTIVE COMMITTEE ON INTERNATIONAL RADIO (CCIR) OF THE UTI, BOTH OF WHICH HAVE BROAD RESPONSIBILITIES FOR STANDARDIZATION IN TELECOMMUNICATIONS, ALSO ARE CONCERNED WITH TELEPROCESSING. IN ADDITION, SPECIAL COMMITTEES OF THE INTERNATIONAL STANDARDS ORGANIZATIONS (ISO) SUCH AS TECHNICAL COMMITTEE 97 AND SPECIAL COMMITTEE 6 ARE CONCERNED PRIMARILY WITH THIS SMALL BUT DRAMATICALLY GROWING SEGMENT OF COMMUNICATIONS STANDARDIZATION AS AN ADJUNCT TO THE ISO'S OVERALL INFORMATION PROCESSING STANDARDS RESPONSIBILITIES.

IT IS INTERESTING TO NOTE THAT THE ORGANIZATIONS THAT HAVE BEEN ESTABLISHED TO DEAL WITH STANDARDS DEVELOPMENT FOR THE TELECOMMUNICATIONS TECHNOLOGY ARE BOTH OLDER AND SEPARATE FROM THOSE CORRESPONDING ORGANIZATIONS ESTABLISHED FOR INFORMATION PROCESSING STANDARDIZATION. BECAUSE OF FUNDAMENTAL DIFFERENCES BETWEEN THE INDUSTRIES SERVICING THESE TECHNOLOGIES AS WELL AS DIFFERENCES BETWEEN THE POPULATIONS OF USERS, THERE ARE SIGNIFICANT DIFFERENCES BETWEEN THE TWO AREAS IN BOTH THE STANDARDS

DEVELOPMENT AND IMPLEMENTATION PROCESSES. HOWEVER, BECAUSE OF THE INCREASING INTERACTION BETWEEN COMPUTER AND COMMUNICATION SYSTEMS, THERE IS A GROWING AWARENESS OF THE NEED FOR CONSISTENT PROCEDURES AND COMMON PRACTICES BETWEEN THOSE TWO TECHNOLOGIES, PARTICULARLY WITH RESPECT TO DATA COMMUNICATION STANDARDS. AS A RESULT, BOTH TECHNOLOGY AREAS HAVE ESTABLISHED FORMAL STANDARDS COORDINATION AND REVIEW ARRANGEMENTS AMONG THEIR RESPECTIVE TRADE ASSOCIATIONS, INDUSTRY GROUPS, AND NATIONAL AND INTERNATIONAL ORGANIZATIONS FOR DEALING WITH DATA COMMUNICATION STANDARDS.

RECOGNIZING THE EXTENSIVE ACTIVITY AND BROAD INVOLVEMENT OF MANY GROUPS IN THE DEVELOPMENT OF TELEPROCESSING STANDARDS,--PERHAPS I SHOULD MORE ACCURATELY SAY "STANDARDS TO FACILITATE TELEPROCESSING"--IT MAY BE WELL TO REMIND OURSELVES OF <u>WHY</u> WE WANT AND NEED SUCH STANDARDS. IN OTHER WORDS--"WHAT ARE THE OBJECTIVES OF THE TELEPROCESSING STANDARDS PROGRAM?"

THE OBJECTIVES ARE THREE-FOLD:

<u>FIRST</u>: TO ASSURE THE PROPER INTERCONNECTION OF DATA TERMINAL EQUIPMENT WITH COMPUTERS, AND TO FACILITATE THE NETWORKING OF COMPUTERS, EMPLOYING DATA COMMUNICATIONS FACILITIES, FOR THE INTERCHANGE OF INFORMATION. <u>THIS OBJECTIVE CAN BE SEEN AS DIRECTED TOWARDS IMPROVED AND EXTENDED OPERATIONS.</u>

<u>SECOND</u>: TO ACHIEVE EFFECTIVE TELEPROCESSING BY INSURING COMPATIBILITY OF FACILITIES THROUGH STANDARDS WHICH PERMIT THE INTERCHANGE OF COMPONENTS AND EQUIPMENT AMONG SYSTEMS FURNISHED BY DIFFERENT SUPPLIERS. <u>THIS OBJECTIVE CAN BE SEEN</u>

AS DIRECTED TOWARDS EQUIPMENT INTERCHANGEABILITY AND INTERCONNECTIVITY.

THIRD: TO ASSURE ECONOMIC AND COMPETITIVE PROCUREMENTS OF ADP AND TELECOMMUNICATIONS FACILITIES, BY ADOPTING STANDARDS DEVELOPED BY AND ACCEPTABLE TO BOTH THE INDUSTRY AND THE GOVERNMENT. THIS OBJECTIVE CAN BE SEEN AS DIRECTED TOWARDS WIDER SOURCES OF SUPPLY FOR HARDWARE AND SOFTWARE.

WHAT THEN, ARE THE STANDARDS DEVELOPED OR BEING PURSUED IN RESPONSE TO THESE OBJECTIVES?

SLIDE #4 -- DATA COMMUNICATIONS AND TELEPROCESSING

COMMENTARY:

- THE THREE THAT HAVE BEEN PUBLISHED THUS FAR RELATE TO:
  (1) BIT SEQUENCING OF THE CODE FOR INFORMATION INTERCHANGE IN SERIAL-BY-BIT DATA TRANSMISSION.
  (2) CHARACTER STRUCTURE AND CHARACTER PARITY SENSE FOR PARALLEL-BY-BIT DATA COMMUNICATION IN THE CODE FOR INFORMATION INTERCHANGE.
  (3) CHARACTER STRUCTURE AND CHARACTER PARITY SENSE FOR SERIAL-BY-BIT DATA COMMUNICATION IN THE CODE FOR INFORMATION INTERCHANGE.
- THE TWO EXPECTED TO BE PUBLISHED BY THE END OF THIS YEAR DEAL WITH:
  (1) SPECIFYING SIGNALING SPEEDS FOR VOICE-GRADE

TELEPHONE CIRCUITS THAT RANGE FROM 75 BITS-PER-SECOND UP TO 9600 BITS-PER-SECOND, AND ALSO SPECIFYING SIGNALING RATES FOR WIDE BAND CHANNELS RANGING FROM ABOVE 48 KILOBITS TO 5 MEGABITS PER SECOND; AND

(2) "DATA COMMUNICATION SYSTEMS PERFORMANCE" DETERMINATION PROCEDURES. THIS WILL PRESCRIBE CRITERIA AND MEASUREMENT PROCEDURES FOR DETERMINING THE PERFORMANCE OF DATA COMMUNICATION SYSTEMS. IT WILL PROBABLY BE PROCESSED AS A FIPS GUIDELINE CONCURRENT WITH ITS ADOPTION BY THE INDUSTRY STANDARDS GROUP IN THE U.S.A.

I MENTIONED EARLIER THAT SOME SIX OTHER STANDARDS FOR TELEPROCESSING ARE EXPECTED TO BE PUBLISHED DURING THE COMING YEAR. THESE ARE SHOWN ON THE NEXT CHART.

SLIDE #5
DATA COMMUNICATIONS & TELEPROCESSING (CONT'D)

COMMENTARY:

- THE SUBJECTS DEAL WITH:
  - CODE INDEPENDENT CONTROL PROCEDURES
  - HEADING FORMATS
  - INTERFACE BETWEEN DATA TERMINAL AND DATA COMMUNICATIONS EQUIPMENT
  - USE OF ASCII COMMUNICATIONS CONTROL CHARACTERS
  - SIGNAL QUALITY
  - SYNCHRONOUS SIGNALLING RATES (WIDE BAND)

° I AM PREPARED TO COMMENT UPON EACH OF THESE IN GREATER DETAIL. HOWEVER, SINCE OUR TIME IS SHORT, LET M[illegible]HAT IF ANY OF YOU WISH TO ENQUIRE FURT[illegible]NDING THESE, WE MIGHT DO S[illegible] ON AN INDIVIDUAL BASIS LATER DURING OUR TIME TOGETHER AT THE CONGRESS.

V NCS ACTIONS IN SUMMARY:

1). APPROXIMATELY 1 YEAR AGO AGREEMENTS WERE REACHED BETWEEN NCS & NBS REGARDING THE "EXCLUSIVE AND MUTUAL RESPONSIBILITIES FOR THE DEVELOPMENT OF FEDERAL STANDARDS RELATED TO DATA TRANSMISSION AND TELEPROCESSING"

2). THESE AGREEMENTS WERE APPROVED IN JUNE 1972. SUBSEQUENTLY THE GSA NAMED NCS AS THE "DELEGATE AGENCY" FOR FEDERAL TELECOMMUNICATIONS STANDARDS.

3). A "FEDERAL TELECOMMUNICATIONS STANDARDS COMMITTEE" HAS BEEN FORMED.

° 1ST MEETING WAS HELD IN OCTOBER, 1972.

° 3 MEETINGS HAVE BEEN HELD TO DATE. THE NEXT MEETING IS SCHEDULED FOR DECEMBER, 1972.

° 14 AGENCIES OR GOVERNMENT OFFICES ARE REPRESENTED ON THE COMMITTEE.

° MR. MARSHALL CAINE, ASSISTANT MANAGER FOR NCS COMPATABILITY IS CHAIRMAN OF THE FTSC.

° NBS IS AN EX-OFFICIO MEMBER OF THE FTSC.

4). A "SYSTEMS STANDARDS TASK FORCE" HAS BEEN ESTABLISHED TO RECOMMEND NEEDED STANDARDS, AND TO PRIORITIZE WORK ACTIVITIES OF THE FTSC.

5). PUBLICATION OF THE FIRST STANDARDS CAN BE EXPECTED IN ABOUT A YEAR. IN THE INTERIM, AT LEAST 3 STANDARDS JOINTLY DEVELOPED BY NBS AN[illegible]S, ARE BEING ISSUED AS FIPS PUBLICATIONS.

VI. Conclusion

Finally, may I extend to each of you an open invitation to visit with the Center for Computer Sciences and Technology of the National Bureau of Standards in Washington, D.C., for further discussions and information regarding the development of standards for automatic data processing, telecommunications, and the product of the marriage of these two technologies--teleprocessing.

Thank you for your patient attention.

SLIDE 1

FIPS PROGRAM AREAS

- Policy, Procedures and Administration
- Programming Languages
- Components and Devices
- Data Communications and Teleprocessing
- Character Sets and Related Topics
- Media
- Source Data Automation
- Applications and Data
- Documentation and Environment

SLIDE 2

STANDARDS DEVELOPMENT CYCLE

- IDENTIFICATION OF NEED
- DEVELOPMENT OF TECHNICAL SPECIFICATION
- PREPARATION OF DRAFT FIPS PUB
- REVIEW AND COORDINATION
- RECOMMENDATION
- APPROVAL
- PUBLICATION

SLIDE 3

FEDERAL INFORMATION PROCESSING STANDARDS COMMITTEES

- FIPSCAC
- FIPS Task Groups
  1. Objectives and Requirements
  2. Data Transmission
  3. Subsets, Sign Conventions, etc.
  4. Terminology for RFP's
  5. Vocabulary
  6. Magnetic Reference Tapes
  7. Magnetic Tape Labels
  8. Data Interchange Formats
  9. COBOL Standard
  10. Performance Evaluation
  11. Optical Character Recognition

SLIDE 4

DATA COMMUNICATIONS & TELEPROCESSING

° BIT SEQUENCING	FIPS PUB 16
° CHARACTER STRUCTURE, ETC. SERIAL-BY-BIT	FIPS PUB 17
° CHARACTER STRUCTURE, ETC. PARALLEL-BY-BIT	FIPS PUB 18
° SYNCHRONOUS SIGNALLING RATES	1972
° DATA COMMUNICATIONS SYSTEM PERFORMANCE	1972

SLIDE 5

DATA COMMUNICATIONS & TELEPROCESSING (CONT.)

- CODE INDEPENDENT CONTROL PROCEDURES
- HEADING FORMATS
- INTERFACE BETWEEN DATA TERMINAL AND DATA COMMUNICATIONS EQUIPMENT
- USE OF ASCII COMMUNICATIONS CONTROL CHARACTERS
- SIGNAL QUALITY
- SYNCHRONOUS SIGNALLING RATES (WIDE BAND)